HYDROMETEOROLOGICAL DESIGN STUDIES CENTER
QUARTERLY PROGRESS REPORT

1 July 2008 to 30 September 2008

Office of Hydrologic Development

U.S. National Weather Service

National Oceanic and Atmospheric Administration

Silver Spring, Maryland

October 2008

DISCLAIMER

The data and information presented in this report are provided only to demonstrate current progress on the various technical tasks associated with these projects. Values presented herein are NOT intended for any other use beyond the scope of this progress report. Anyone using any data or information presented in this report for any other purpose does so at their own risk.

TABLE OF CONTENTS

I. INTRODUCTION

The Hydrometeorological Design Studies Center (HDSC) within the Office of Hydrologic Development of National Oceanic and Atmospheric Administration's (NOAA) National Weather Service (NWS) is updating precipitation frequency estimates for various parts of the United States. Updated precipitation frequency estimates for durations from 5 minutes to 60 days and selected average recurrence intervals (1-year to 1000-year) accompanied by additional information (e.g., 90% confidence intervals, temporal distributions, seasonality) are published in NOAA Atlas 14. The Atlas is divided into volumes based on geographic sections of the country. NOAA Atlas 14 is a web-based document available through the Precipitation Frequency Data Server (http://hdsc.nws.noaa.gov/hdsc/pfds/index.html).

HDSC is currently updating precipitation frequency estimates for Hawaii (NOAA Atlas 14, Volume IV) and the remainder of California (NOAA Atlas 14, Volume V) not included in NOAA Atlas 14, Volume I. We also began updating precipitation frequency estimates for the U.S. Pacific Islands. While formal agreements are being put into place, we initiated precipitation frequency projects for the Southeastern states (Alabama, Arkansas, Georgia, Florida, Louisiana and Mississippi), the Midwestern states (Colorado, Iowa, Kansas, Minnesota, Missouri, Nebraska, North Dakota, South Dakota, and Wisconsin), and Alaska. Figure 1 shows new project areas as well as project areas included in NOAA Atlas 14 Volumes 1 to 3.

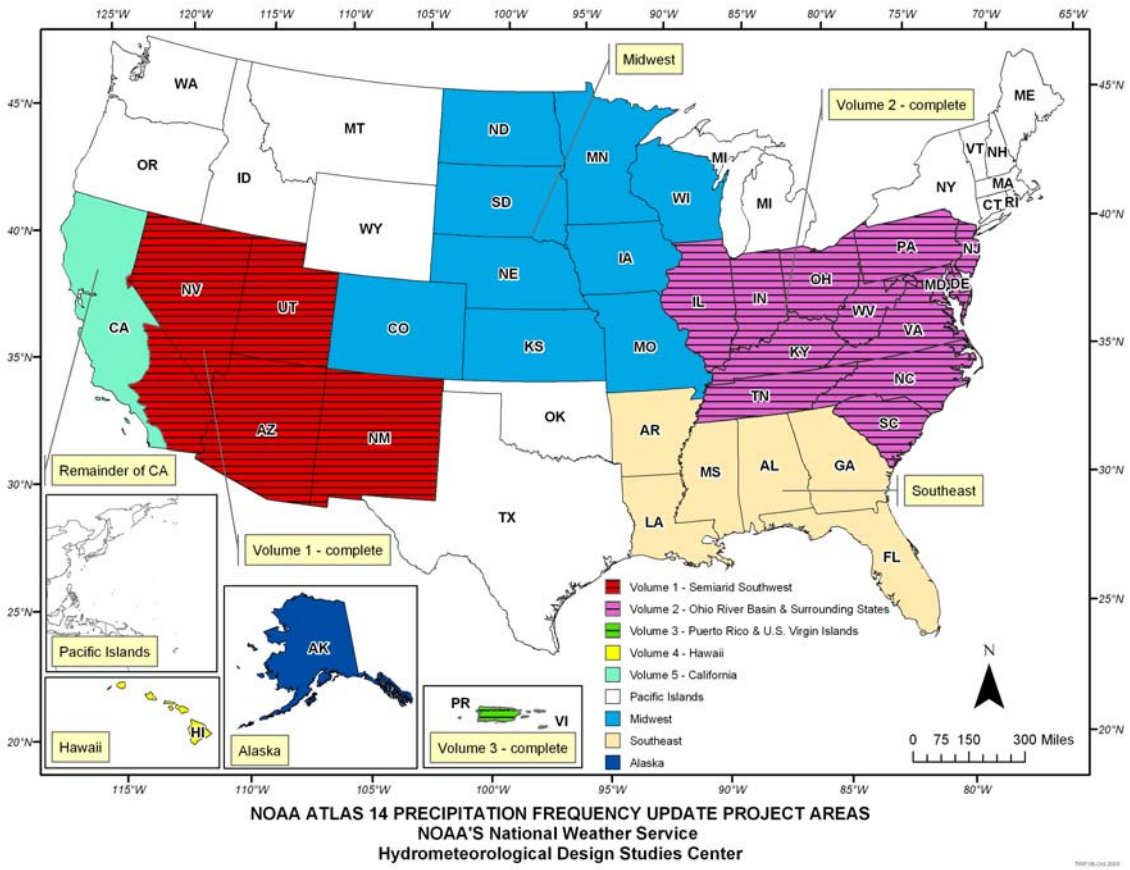

Figure 1. Map showing current project areas and project areas for Volumes 1-3.

II. CURRENT PROJECTS

1. PRECIPITATION FREQUENCY PROJECT FOR HAWAII

1.1. PROGRESS IN THIS REPORTING PERIOD (Jul-Sep 2008)

During a comprehensive internal review of at-site precipitation frequency (PF) estimates, inconsistencies in PFs (for example, 4-day PF estimate is less than 2-day PF estimate for a given average recurrence interval) among durations were noted at some stations. It is not uncommon that, due to data imperfections and the fact that precipitation frequency estimates for different durations are computed independently, inconsistencies among durations occur. Typically this requires only minor adjustments of PFs. For the Hawaii project, however, required adjustments were larger, primarily at stations with data accumulated over periods greater than a day. In these cases the distribution of the total amount among the days is unknown. At those stations, annual maxima were extracted only for durations for which the data passed our extraction criteria (see December 2007 Quarterly Progress Report at http://www.nws.noaa.gov/oh/hdsc/current-projects/pdfs/HDSC_PR_Jan08.pdf for details). This often precluded the extraction of annual maxima at shorter durations, notably 1-day and 2-day, and resulting in very different sample properties across durations.

We resolved the issue by re-examining the annual maximum (AM) series, correcting data errors that were not previously identified, removing low outliers in AM series, adjusting factors for converting constrained to unconstrained measurements and smoothing precipitation frequency estimates across durations. More details on the procedure are given in Sections 1.1.1. and 1.1.2.

These consistency adjustments, delayed starting the peer review from July 2008 until 22 September 2008.

1.1.1. Data analysis

a. Quality control of annual maximum series

Additional statistical tests were applied in effort to identify all low outliers in annual maximum series. 135 flagged potential outliers were carefully investigated; the majority occurred in years with missing or accumulated data during significant events and they were deleted.

Three stations were deleted due to poor data and the fact that stations with more reliable data existed nearby to anchor the spatial interpolation. The stations deleted are: 51-1887 (daily region 4), 51-9738 (daily region 22), and 51-3268 (daily region 26). For quick reference, daily and hourly regions are shown in Figures 2 and 3, respectively. More information on region delineation can be found in previous progress reports at http://www.nws.noaa.gov/ohd/hdsc/current_projects.html. At station 51-8155 (daily region 8), missing daily data was replaced with accumulated hourly data to resolve inconsistencies between the hourly and daily datasets. For collocated stations, 1-day AM from hourly data and from daily data were compared and adjustments were made as needed.

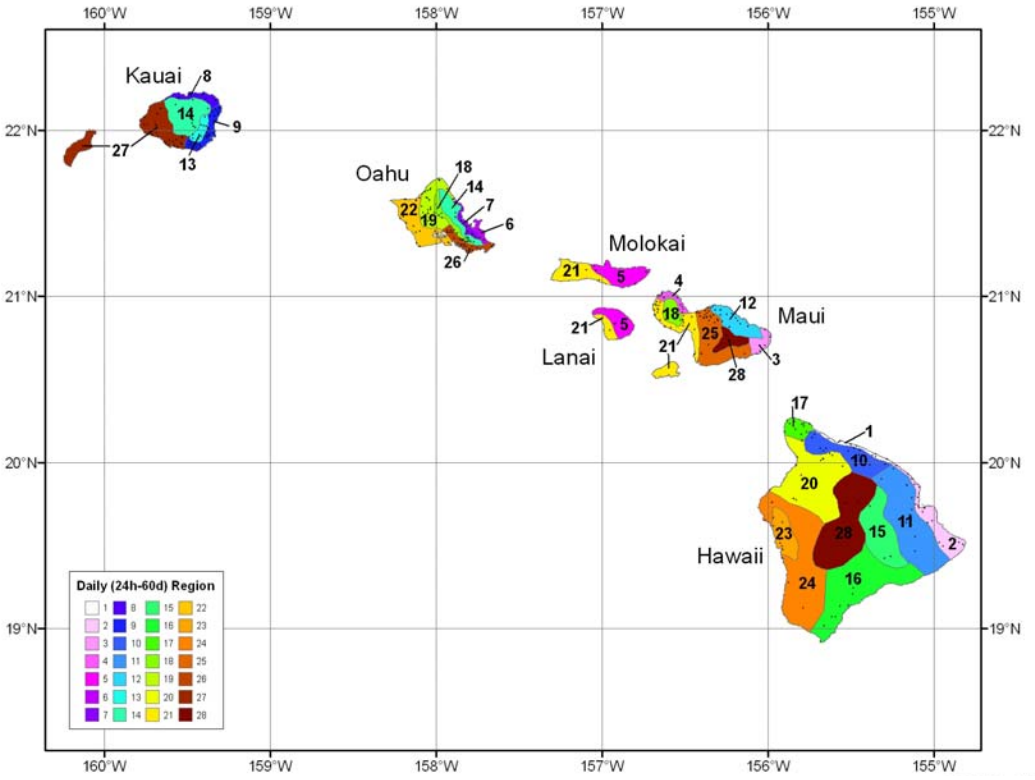

Figure 2. Twenty-eight regions applicable for durations 1-day through 60-day.

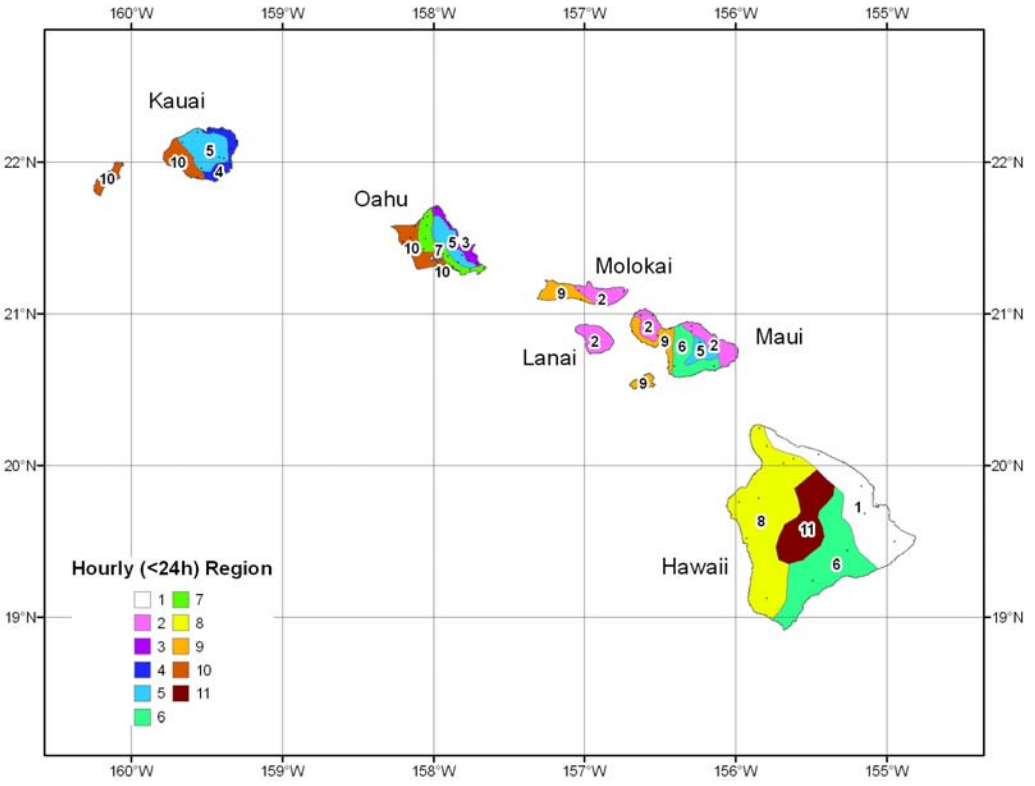

Figure 3. Eleven regions applicable for durations less than 24-hour.

b. Conversion factors

Conversion factors are used to convert constrained (i.e., with pre-defined start time) to unconstrained measurements for a given duration. While investigating the issue of inconsistencies in precipitation frequency estimates (Section 1.1.2), we also reevaluated conversion factors as we suspected that in some cases the conversion factor contributed to unnatural transitions in precipitation frequencies from duration to duration. Both, old and updated conversion factors are shown in Table 1.

Table 1. "Old" and updated conversion factors.

Duration	**1-hr**	**2-hr**	**3-hr**	**6-hr**	**12-hr**	**1-day**	**2-day**	**> 2-day**
Old conv. factors	1.11	1.03	1.00	1.00	1.00	1.17	1.07	1.00
New conv. factors	1.11	1.03	1.00	1.00	1.00	1.10	1.05	1.00

1.1.2. Resolving inconsistencies in at-site PF estimates across durations

Several approaches were investigated to resolve inconsistencies in at-site PF estimates across durations: a) smoothing PF estimates indirectly by smoothing regional statistics (specifically, smoothing a shape coefficient of General Extreme Value distribution across durations); b) directly smoothing PF estimates using n-order polynomials (regular and log transformations); and c) eliminating AM at durations where historical data had significantly different statistical properties than historical data at other durations (particularly sample size). PF adjustments were carefully examined at all stations. Although all three approaches resulted in more consistent PF estimates, at some stations, particularly at collocated stations, the PF adjustments ended up being considerable for T > 100 year frequencies for some durations. It was determined that a combination of approaches b) and c) was the best solution and it was therefore applied at all sites. The adjustments resulted in minor (if any) PF changes at the majority of stations and durations, and it created reasonable estimates at stations with inconsistencies issues. An example of adjustment performed at site #51-0006 is shown in Figure 4.

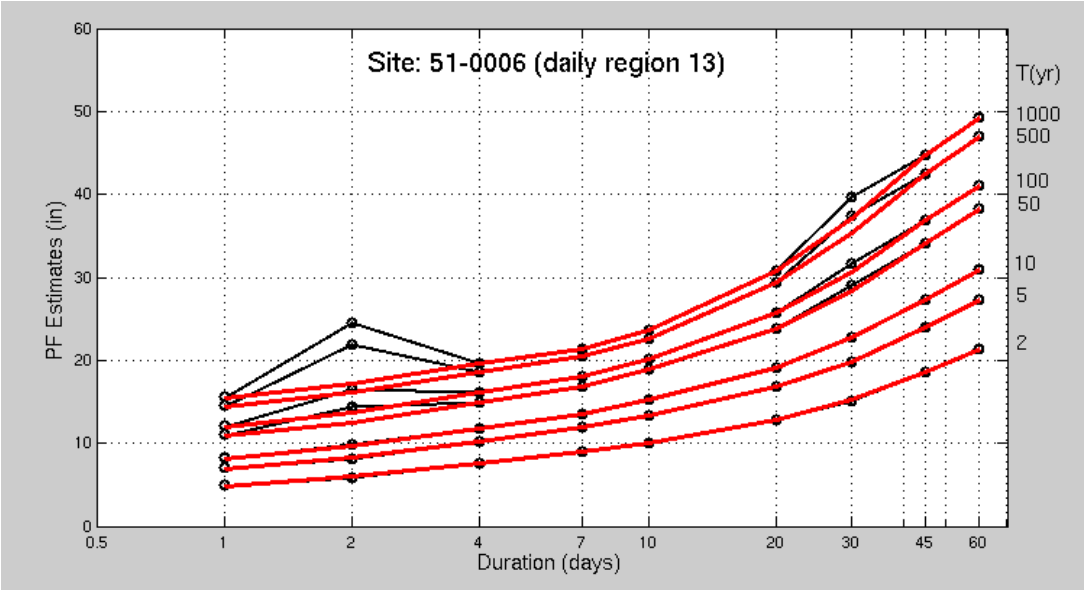

Figure 4. Adjusted (red) vs. original (black) precipitation frequency estimates for station 51-0006.

1.1.3. Spatial interpolation of at-site mean annual maximum estimates

Revised at-site mean annual maximum (MAM) estimates were submitted to Oregon State University's PRISM Group for spatial interpolation. Our Cascade Residual Add-Back (CRAB) methodology (details on methodology are available in NOAA 14 documents posted here: http://www.nws.noaa.gov/ohd/hdsc/currentpf.htm), was used on the MAM grids supplied by the PRIM Group to develop spatially interpolated precipitation frequency estimates. Color cartographic maps of interpolated MAMs and 100-year estimates for selected durations (60-minute, 12-hour, 1-day and 10-day) were submitted for the peer review (see Section 1.1.4).

1.1.4. Peer review

The Hawaii precipitation frequency peer review began on 22 September 2008. We requested any feedback to be submitted via e-mail (HDSC.Questions@noaa.gov) by Friday, 31 October 2008. All of the review materials will be available until the deadline via the following web pages:

Island:	**Link:**
Kauai, Niihau:	http://hdsc.nws.noaa.gov/hdsc/pfds/hi/kauai_pfds.html
Oahu:	http://hdsc.nws.noaa.gov/hdsc/pfds/hi/oahu_pfds.html
Maui, Molokai, Lanai, Kahoolawe:	http://hdsc.nws.noaa.gov/hdsc/pfds/hi/maui_pfds.html
Hawaii ("Big Island"):	http://hdsc.nws.noaa.gov/hdsc/pfds/hi/hawaii_pfds.html

Briefly, the review material includes regionalized groups of stations used to compute precipitation frequency estimates, point precipitation frequency estimates (via the interactive Precipitation Frequency Data Server), spatially interpolated maps for MAM and AM-based 100-year PFs for 60-minute, 12-hour, 1-day, and 10-day durations (in PDF format).

1.1.5. Precipitation frequency estimates from partial duration series

An investigation was conducted to ascertain the value of current HDSC approach for computing precipitation frequency estimates from partial duration (PD) series. The current approach, which is based on regional frequency analysis on independently extracted PD series, was compared to a commonly used approach that uses Langbein's (Chow's) formula to relate average recurrence intervals for AM and PD series. After a thorough investigation, it was decided to adopt Langbein's formula to estimate PD-based precipitation frequency estimates for the Hawai'i study (and likely for all future studies). This will make the process by which PD-based PF estimates are computed more efficient and consistent.

1.2. PROJECTED ACTIVITIES FOR THE NEXT REPORTING PERIOD (Oct-Dec 2008)

1.2.1. Peer review

The Hawaii precipitation frequency peer review is scheduled to end on 31 October 2008. HDSC will address all comments and share the questions and responses in a consolidated document with users through our list-server. The consolidated document will also be made available on the HDSC web site.

1.2.2. Confidence limits

Confidence limits will be computed for all durations and frequencies. HDSC is investigating several alternatives to our current approach which is based on Monte-Carlo simulation.

1.2.3. Final at-site MAM and precipitation frequency estimates

Upon completing the peer review, appropriate changes will be made to the precipitation frequency estimates, regions, MAMs, etc.

1.2.4. Final MAM and PF grids

HDSC will supply final at-site MAMs to PRISM group for spatial interpolation. The MAM grids will then serve as the basis for spatial interpolation of the precipitation frequency estimates (and confidence limits). The final PF grids will be posted to the PFDS so an internal review of the final results can take place before release to the public.

1.3. PROJECTED SCHEDULE

Peer review of estimates [October 2008]

Development of precipitation frequency estimates for PD series [November 2008]

Development of final precipitation frequency grids for all durations based on PRISM deliverables and other remaining tasks (seasonality, temporal distributions, documentation, etc.) [February 2009]

Web publication [March 2009]

2. PRECIPITATION FREQUENCY PROJECT FOR THE REMAINDER OF CALIFORNIA

2.1. PROGRESS IN THIS REPORTING PERIOD (Jul-Sep 2008)

The agreement between NOAA/NWS and the State of California for partial funding of this work has been signed. We expect funds to be transferred during the next fiscal year (starting in October 2008), however arrangements have been made for us to proceed with the project in this fiscal year.

HDSC has made progress in compiling and formatting of the datasets collected from a number of sources. Table 2 provides basic information on datasets: data type, data source, number of stations in each processed dataset, and current status of data formatting including some comments/notes about each task. The numbers of stations are subject to change as we further review the data, eliminate duplicate stations, impose a minimum number of years of data, and merge appropriate stations, etc.

The quality control of metadata (latitude, longitude, elevation) continues. A review of station metadata allows us to: a) identify erroneous metadata (by comparison with high resolution DEM, other stations with similar name, etc.) and assign new elevation, longitude and/or latitude as needed; b) merge collocated stations; c) omit duplicate stations.

Table 2. List of data types, data sources, number of stations in each processed dataset, current status of formatting and comments (ALERT data are Automated Local Evaluation in Real Time gauges that measure precipitation using tipping buckets in increments of 0.04 in).

Data Type	Data Source	Number of Stations	Status of Formatting	Comments
Daily	National Climatic Data Center	1212	Done	
	CA Department of Water Resources	382	Done	
	U.S. Army Corps of Engineers	43	Done	
	Santa Barbara County Flood Control District	161	Done	
	LA County Dept. of Public Works	1146	Done	Number will reduce significantly as stations are merged
	San Diego County Flood Control District	67	Done	
	California Nevada River Forecast Center	553	Done	6-hr ALERT data accumulated to daily; 1-hr data not available
	Ventura County Watershed Protection District	104	Done	
	City of Roseville, Dept. of Public Works	6	Done	
	Santa Clara Valley Water District	TBD		Waiting for data
	U.S. Geological Survey	10	Done	
	Lake County Watershed Protection District, University of California	400		Mostly NCDC and Dept. of Water Res. data; some daily some hourly
	Contra Costa Flood Control District and Water Conservation District	15		
	SNOTEL	152	Done	

Hourly	National Climatic Data Center	477	Done	
	CA Department of Water Resources	345	Done	
	U.S. Army Corps of Engineers	43	Done	
	Metro Flood Control District, Fresno	8	Done	
	Jim Goodridge, Retired State Climatologist	337	Done	
	RAWS	250	Done	
	City of Roseville, Dept. of Public Works	5	Done	
	Santa Clara Valley Water District	TBD		Waiting for data
	USGS	6	Done	
	Lake County Watershed Protection District, University of California	400		See comments under daily data
	SNOTEL	46	Done	
15-min	National Climatic Data Center	477	Done	
5-min	Ventura County Watershed Protection District	105		
	Santa Barbara County Flood Control District	49		
	LA County Dept. of Public Works	41	Done	
	Riverside County Flood Control District	TBD		
	Contra Costa Flood Control District and Water Conservation District	5		
ALERT	Orange County California Dept. of Parks & Recreation	45	Done	
	San Diego County Flood Control District	70	Done	
	Marin County Flood Control and Water Conservation District	5	Done	
	Monterey County Water Resources Agency	TBD		Waiting for a list of stations to compare with what we already have.

2.2. PROJECTED ACTIVITIES FOR THE NEXT REPORTING PERIOD (Oct-Dec 2008)

HDSC will continue to format data and evaluate metadata. We will begin the quality control of the daily data.

2.3. PROJECTED SCHEDULE

Data collection, formatting and initial quality control [December 2008]

Extraction of annual maximum series (AMS); additional quality control and data reliability tests (e.g., outliers, trend analysis, independence, consistency across durations, duplicate stations, candidates for merging) [February 2009]

Regionalization and frequency analysis [March 2009]

Initial spatial interpolation of PF estimates and consistency checks across durations [May 2009]

Peer review [June 2009]

Revision of PF estimates [July 2009]

Remaining tasks (e.g., development of precipitation frequency estimates for PD series, seasonality, temporal distributions, documentation) [August 2009]

Web publication [September 2009]

3. PRECIPITATION FREQUENCY PROJECT FOR THE U.S. PACIFIC ISLANDS

3.1. PROGRESS IN THIS REPORTING PERIOD (Jul-Sep 2008)

HDSC initiated a project to update the precipitation frequency estimates of the U.S. Pacific Islands. The project will include the following islands:

- Territory of Guam,
- Saipan and Rota of the Commonwealth of Northern Mariana Islands (CNMI),
- Yap, Chuuk, Pohnpei and Kosrae of the Federated States of Micronesia (FSM),
- Koror of the Republic of Palau,
- Majuro Atoll of the Republic of the Marshall Islands (RMI),
- Tutuila and Manua of American Samoa, and
- Wake Island.

3.1.1. Data collection

HDSC has made progress in reviewing related studies, establishing a project area, seeking precipitation data and compiling datasets for the Pacific Islands project. A data solicitation email was sent on 15 September 2008. Feedback was received from three parties.

Table 3 provides basic information on datasets: data source, data type, number of stations in each dataset (subject to change), and some comments/notes about the task.

Table 3. List of data sources, data types, number of stations in each dataset with comments.

Data Source	Data type	Number of stations	Comments
National Climatic Data Center	daily	58	
	hourly	12	
	15-min	9	
Tropical Rainfall Measuring Mission rmm-fc.gsfc.nasa.gov/trmm_gv/	n-min	~25	Ground validation program in Guam and Kwajalein of Marshall Islands. Data available for 1997-2008.
Comprehensive Pacific Rainfall Data Base (PACRAIN) http://pacrain.evac.ou.edu/	varies	TBD	Developed under NOAA/Office of Global Programs research grant
U.S. Geological Survey (USGS) http://hi.water.usgs.gov/studies/project_waterdata.htm	hourly	16	16 stations with 12 years of data, spread among Saipan, Guam, Palau and American Samoa

3.2. PROJECTED ACTIVITIES FOR THE NEXT REPORTING PERIOD (Oct-Dec 2008)

Efforts to collect, reformat and quality control precipitation data will continue.

3.3. PROJECTED SCHEDULE

Data collection, formatting and initial quality control [December 2008]

Extraction of annual maximum series (AMS); additional quality control and data reliability tests (e.g., outliers, trend analysis, independence, consistency across durations, duplicate stations, candidates for merging) [February 2009]

Regionalization and frequency analysis [March 2009]

Initial spatial interpolation of PF estimates and consistency checks across durations [May 2009]

Peer review [June 2009]

Revision of PF estimates [July 2009]

Remaining tasks (e.g., development of precipitation frequency estimates for PD series, seasonality, temporal distributions, documentation) [August 2009]

Web publication [September 2009]

4. PRECIPITATION FREQUENCY PROJECT FOR THE SOUTHEASTERN STATES

4.1. PROGRESS IN THIS REPORTING PERIOD (Jul-Sep 2008)

While formal agreements are still being put into place, we began data collection for a precipitation frequency project for the Southeastern states of Alabama, Arkansas, Georgia, Florida, Louisiana and Mississippi. The National Weather Service Southern Region initiated efforts to identify potential partners to help fund expansion of this project to include Oklahoma and Texas.

At this early stage, the main focus has been on data collection and reformatting. On 22 August 2008, we sent an email to our list-server as well as a targeted list of 26 potential data providers requesting information about potential precipitation data sources. Although our primary data source is the National Climatic Data Center (NCDC), additional datasets have proven very helpful in previous studies. We've received 11 responses to date. Certainly, if you have or know of any other available data, please let us know (email HDSC.Questions@noaa.gov). Table 4 provides a summary of the current data sources and data types.

Table 4. Current list of precipitation data sources and data types.

Data Source	Data Type
National Climatic Data Center	daily, hourly, 15-min
Natural Resources Management Office, Brevard County, Florida	daily
Public Waters and Utilities Administration, City of Melbourne, Florida	TBD
University of Central Florida, Orlando, Florida	TBD
Brevard County Utility Services Department, Florida	daily
USGS, Georgia Water Science Center	daily

4.2. PROJECTED ACTIVITIES FOR THE NEXT REPORTING PERIOD (Oct-Dec 2008)

The main focus will continue to be data acquisition, evaluation and re-formatting.

4.3. PROJECTED SCHEDULE (as months from start)

Data collection, formatting and initial quality control [+3 months]

Extraction of annual maximum series (AMS); additional quality control and data reliability tests (e.g., outliers, trend analysis, independence, consistency across durations, duplicate stations, candidates for merging) [+14 months]

Regionalization and frequency analysis [+18 months]

Initial spatial interpolation of PF estimates and consistency checks across durations [+24 months]

Peer review [+ 26 months]

Revision of PF estimates [+29 months]

Remaining tasks (e.g., development of precipitation frequency estimates for PD series, seasonality, temporal distributions, documentation) [+35 months]

Web publication [+36 months]

5. PRECIPITATION FREQUENCY PROJECT FOR THE MIDWESTERN STATES

5.1. PROGRESS IN THIS REPORTING PERIOD (Jul-Sep 2008)

We are working with Federal Highway Administration (FHWA) to finalize the contractual relationship between FHWA and NWS for the Midwestern Precipitation Frequency Project. While formal agreements are being put into place, we began data collection for the Midwestern states of Colorado, Iowa, Kansas, Minnesota, Missouri, Nebraska, North Dakota, South Dakota, and Wisconsin.

At this early stage, the main focus has been on data collection and reformatting. On 22 August 2008, we sent an email to our List-Server as well as a targeted list of 27 potential data providers requesting information about potential precipitation data sources. Although our primary data source is the National Climatic Data Center (NCDC), additional datasets have proven very helpful in previous studies. We've received responses from several sources to our email data. Certainly, if you have or know of any other available data, please let us know (email HDSC.Questions@noaa.gov). Table 5 provides current list of data sources and data types available.

Table 5. Current list of precipitation data sources and data types.

Data Source	Data Type
National Climatic Data Center	daily, hourly, 15-min
Minnesota State Climatology Office, Department of Natural Resources	daily
North Dakota State Water Commission	daily; monthly
Minnesota Department of Transportation	TBD
Kansas Department of Transportation	n-minute
Colorado Climate Center, Colorado State University	TBD
Oklahoma Mesonet	n-minute; hourly
Arkansas-Red Basin River Forecast Center, NWS	daily; hourly
Univ. of Missouri, Atmospheric Sciences Department	daily; hourly
Colorado Springs Utilities	daily
North Dakota Agricultural Weather Network	hourly
US Army Corps of Engineers, Omaha District Office	daily; hourly

5.2. PROJECTED ACTIVITIES FOR THE NEXT REPORTING PERIOD (Oct-Dec 2008)

The main focus will continue to be data acquisition, evaluation and re-formatting. Thereafter, some initial quality control may begin.

5.3. PROJECTED SCHEDULE (as months from start)

Data collection, formatting and initial quality control [+3 months]

Extraction of annual maximum series (AMS); additional quality control and data reliability tests (e.g., outliers, trend analysis, independence, consistency across durations, duplicate stations, candidates for merging) [+14 months]

Regionalization and frequency analysis [+18 months]

Initial spatial interpolation of PF estimates and consistency checks across durations [+24 months]

Peer review [+ 26 months]

Revision of PF estimates [+29 months]

Remaining tasks (e.g., development of precipitation frequency estimates for PD series, seasonality, temporal distributions, documentation) [+35 months]

Web publication [+36 months]

6. PRECIPITATION FREQUENCY PROJECT FOR ALASKA

6.1. PROGRESS IN THIS REPORTING PERIOD (Jul-Sep 2008)

With funding now in place, the University of Alaska, Fairbanks (UAF) is moving forward on the joint effort with NWS to update precipitation frequency estimates for Alaska. UAF started with data collection.

6.2. PROJECTED ACTIVITIES FOR THE NEXT REPORTING PERIOD (Oct-Dec 2008)

Arrangements were made to have a UAF representative visit HDSC to coordinate work. The main focus during the next reporting period will continue to be data acquisition and re-formatting.

6.3. PROJECTED SCHEDULE

Data collection, formatting and initial quality control [March 2009]

Extraction of annual maximum series (AMS); additional quality control and data reliability tests (e.g., outliers, trend analysis, independence, consistency across durations, duplicate stations, candidates for merging) [January 2010]

Regionalization and frequency analysis [September 2010]

Initial spatial interpolation of PF estimates and consistency checks across durations [January 2011]

Peer review [March 2001]

Revision of PF estimates [May 2011]

Remaining tasks (e.g., development of precipitation frequency estimates for PD series, seasonality, temporal distributions, documentation) [August 2011]

Web publication [September 2011]

7. AREAL REDUCTION FACTORS

7.1. PROGRESS IN THIS REPORTING PERIOD (Jul-Sep 2008)

HDSC is developing geographically-fixed areal reduction factors that can be used to convert point precipitation frequency estimates into corresponding areal estimates in the United States. For a given average recurrence interval, rainfall duration and area size, the areal reduction factor (ARF) is defined as a ratio of average point depth and areal depth with the same recurrence interval.

Insufficient time and resources have prevented this project from moving forward, but that is expected to change as HDSC expands its human resources.

7.2. PROJECTED ACTIVITIES FOR THE NEXT REPORTING PERIOD (Oct-Dec 2008)

No progress is expected to be made on this project during the next reporting period. When additional resources become available, the HDSC will investigate an approach that utilizes radar-estimated precipitation.

III. OTHER

1. PRESENTATIONS AND MEETINGS

On 26-29 August 2008 Geoff Bonnin attended the 2008 National Hydraulic Engineering Conference in Portland, Maine held by U.S. Department of Transportation (DOT), Federal Highway Administration (FHWA). He presented precipitation frequency work as a round-table discussion. Various State DOT hydraulic engineers attended.

On 3 September 2008 Geoff Bonnin and Sanja Perica had a teleconference with the stakeholders of the Southeastern States Precipitation Frequency Project. The participating states are ready to transfer funds to FHWA by 1 October 2008.

On 16 September 2008 a meeting with William Merkel of USDA's Natural Resources Conservation Service (NRCS) took place at HDSC. NRCS recently completed a design storm distribution study for the Pacific Islands. Mr. Merkel shared with us the data and the draft NRCS report *Rainfall-Frequency and Design Storm Distribution for Selected Pacific Islands*.

2. ENHANCEMENTS TO HDSC WEB PAGES

A number of changes were made to the HDSC web pages to make them consistent, more user-friendly, and compliant with new Department of Commerce regulations. Additional enhancements will be implemented on current PFDS web pages during the next reporting period.

3. POTENTIAL UPCOMING PROJECTS

NWS Eastern Region headquarters has begun a campaign to obtain funding to update precipitation frequency estimates for the northeastern states of Connecticut, Massachusetts, Maine, New Hampshire, New York, Rhode Island and Vermont continues. New York has signed up on the Federal Highway Administration's pooled fund website (http://www.pooledfund.org/) and is still committed. Maine intends to sign up as well.

4. PERSONNEL

HDSC is growing and now consists of 8 full-time employees/contractors, with two additional people expected to join during the next reporting period and one at the beginning of January.

We were joined by on September 15 by Dr. Li-Chuan Chen, PhD. Dr. Chen is assisting in the research and development of state-of-the-science methods for our work as well as project execution. One more UCAR scientist is expected to join the group in January 2009.

Dan Brewer, a meteorologist who worked in HDSC during the period April-August 2006, returned on 14 August 2008 to assist in various technical tasks.

Two additional people will be hired during the next reporting quarter period to assist in data quality control and other technical tasks.